Medicine Lodge Subbasin Assessment and TMDLs

February 18, 2003

1. Subbasin Assessment – Watershed Characterization

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters (33 USC § 1251.101). States and tribes, pursuant to section 303 of the CWA are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list of impaired waters, currently every two years. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses the water bodies in the Medicine Lodge Subbasin that have been placed on what is known as the "303(d) list."

The overall purpose of this subbasin assessment and TMDL is to characterize and document pollutant loads within the Medicine Lodge Subbasin. The first portion of this document, the subbasin assessment, is partitioned into four major sections: watershed characterization, water quality concerns and status, pollutant source inventory, and a summary of past and present pollution control efforts (Chapters 1 – 4). This information will then be used to develop a TMDL for each pollutant of concern for the Medicine Lodge Subbasin (Chapter 5).

1.1 Introduction

In 1972, Congress passed public law 92-500, the Federal Water Pollution Control Act, more commonly called the Clean Water Act. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Water Pollution Control Federation 1987). The act and the programs it has generated have changed over the years as experience and perceptions of water quality have changed. The CWA has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to insure "swimmable and fishable" conditions. This goal, along with a 1972 goal to restore and maintain chemical, physical, and biological integrity, relates water quality with more than just chemistry.

Background

The federal government, through the U.S. Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the county. The Idaho Department of Environmental Quality (DEQ) implements the CWA in Idaho, while the EPA oversees Idaho and certifies the fulfillment of CWA requirements and responsibilities.

Section 303 of the CWA requires DEQ to adopt, with EPA approval, water quality standards and to review those standards every three years. Additionally, DEQ must monitor waters to identify those not meeting water quality standards. For those waters not meeting standards, DEQ must establish TMDLs for each pollutant impairing the waters. Further, the agency must set appropriate controls to restore water quality and allow the water bodies to meet their designated uses. These requirements result in a list of impaired waters, called the "303(d) list." This list describes water bodies not meeting water quality standards. Waters identified on this list require further analysis. A subbasin assessment and TMDL provide a summary of the water quality status and allowable TMDL for water bodies on the 303(d) list. The *Medicine Lodge Subbasin Assessment and TMDL* provides this summary for the currently listed waters in the Medicine Lodge Subbasin.

The subbasin assessment section of this report (Chapters 1 – 4) includes an evaluation and summary of the current water quality status, pollutant sources, and control actions in the Medicine Lodge Subbasin to date. While this assessment is not a requirement of the TMDL, DEQ performs the assessment to ensure impairment listings are up to date and accurate. The TMDL is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR § 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also includes individual pollutant allocations among various sources discharging the pollutant. The EPA considers certain unnatural conditions, such as flow alteration, a lack of flow, or habitat alteration, that are not the result of the discharge of specific pollutants as "pollution." TMDLs are not required for water bodies impaired by pollution, but not specific pollutants. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

Idaho's Role

Idaho adopts water quality standards to protect public health and welfare, enhance the quality of water, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

The state may assign or designate beneficial uses for particular Idaho water bodies to support. These beneficial uses are identified in the Idaho water quality standards and include:

- Aquatic life support – cold water, seasonal cold water, warm water, salmonid spawning, modified

- Contact recreation – primary (swimming), secondary (boating)

- Water supply – domestic, agricultural, industrial

- Wildlife habitats, aesthetics

The Idaho legislature designates uses for water bodies. Industrial water supply, wildlife habitat, and aesthetics are designated beneficial uses for all water bodies in the state. If a water body is unclassified, then cold water and primary contact recreation are used as additional default designated uses when water bodies are assessed.

A subbasin assessment entails analyzing and integrating multiple types of water body data, such as biological, physical/chemical, and landscape data to address several objectives:

- Determine the degree of designated beneficial use support of the water body (i.e., attaining or not attaining water quality standards).

- Determine the degree of achievement of biological integrity.

- Compile descriptive information about the water body, particularly the identity and location of pollutant sources.

- When water bodies are not attaining water quality standards, determine the causes and extent of the impairment.

1.2 Physical and Biological Characteristics

The Medicine Lodge subbasin is located in Idaho on the northeastern margin of the Snake River plain. Approximately 37 miles of the continental divide, which also marks the state boundary between Idaho and Montana, define the north perimeter of the drainage. The elevation along this portion of the continental divide ranges from 7,500 ft above sea level near Divide Creek, the northern most creek in the drainage, to 10,105 ft at the Red Conglomerate Peaks. The Hydrologic Unit Code (HUC) is rectangular with a width of approximately 7 miles across at the top and narrowing down to less than 4 miles across in the lower half and widening again at the very bottom to approximately 5 mi. The length of the drainage is about 15.3 mi.

The Beaverhead Mountain Range comprises the north portion of the watershed. The various peaks throughout the watershed are shown in Figure 2. The highest peak in the watershed is Scott Peak at 11,394 feet, which is located on the western edge of the subbasin at the headwaters of Webber Creek. Webber Peak (11,180 ft) is just to the south of Scott Peak. Heart Mountain (10,423 ft) and the Red Conglomerate Peaks (10,105 ft) are the other elevation points that are above 10,000 ft in the drainage.

The main stem of Medicine Lodge Creek begins at the northwestern corner and flows in a southeasterly direction until it reaches the eastern border of the HUC about halfway down the HUC at Small, ID. The elevation of Medicine Lodge Creek begins at about 6,500 ft above sea level at the confluence of Fritz Creek and Warm Creek. It lowers to an elevation of 6,132 ft at the confluence with Spring Hollow and continues to Small, ID where the elevation is 5,260 ft. The length of the stretch from the beginning of Medicine Lodge Creek to Small, ID is approximately 21.24 stream miles, giving an approximate average valley gradient of 41 ft/mi. Figure 1 displays the location of the Medicine Lodge watershed.

Figure 1. Medicine Lodge Watershed

Climate

The closest weather reporting station for the Medicine Lodge Drainage is found in Dubois, Idaho, approximately 7.5 miles southeast of Small, ID. The period of record for this discussion is from 1/1/1925 to 4/30/2000. The area is characterized as a semi-arid steppe that ranges in elevation from 5,281 ft above sea level at Small, ID to about 6,500 ft above sea level at the confluence of Fritz Creek and Warm Creek where they join to create Medicine Lodge Creek. Because the elevation of the weather recording station at Dubois is 5,460 ft above sea level, it represents a mid-elevation band (WRCC 2000).

According to long-term records from the Western Regional Climate Center weather station in Dubois, average monthly temperatures range from 18.5?F in

January to 68.6?F in July. The average maximum temperature for July is 73.3?F with a daily extreme of 102?F recorded on July 23, 1931. The average minimum temperature is 10.2?F in January, while the minimum daily extreme of -31?F was recorded on December 22, 1990. Table 1 includes average monthly temperatures (WRCC 2000). Figure 3 and 4 displays the mean monthly temperatures and mean monthly precipitation patterns.

The majority of the precipitation in the drainage occurs as snowfall. The average total snowfall for January is 10.6 in and for December it is 11.8 in. The majority of rainfall occurs in May and June when the mean is 1.69 in and 1.80 in, respectively. The annual mean amount of precipitation is 12.03 in and the annual mean amount of snowfall is 47.9 in. According to the monthly total precipitation by year at the Dubois Experiment Station, the highest recorded year of precipitation occurred in 1995 with an annual amount of 21.34 in. Table 1 includes the average monthly precipitation (WRCC 2000). Figure 5 displays annual precipitation for 1995.

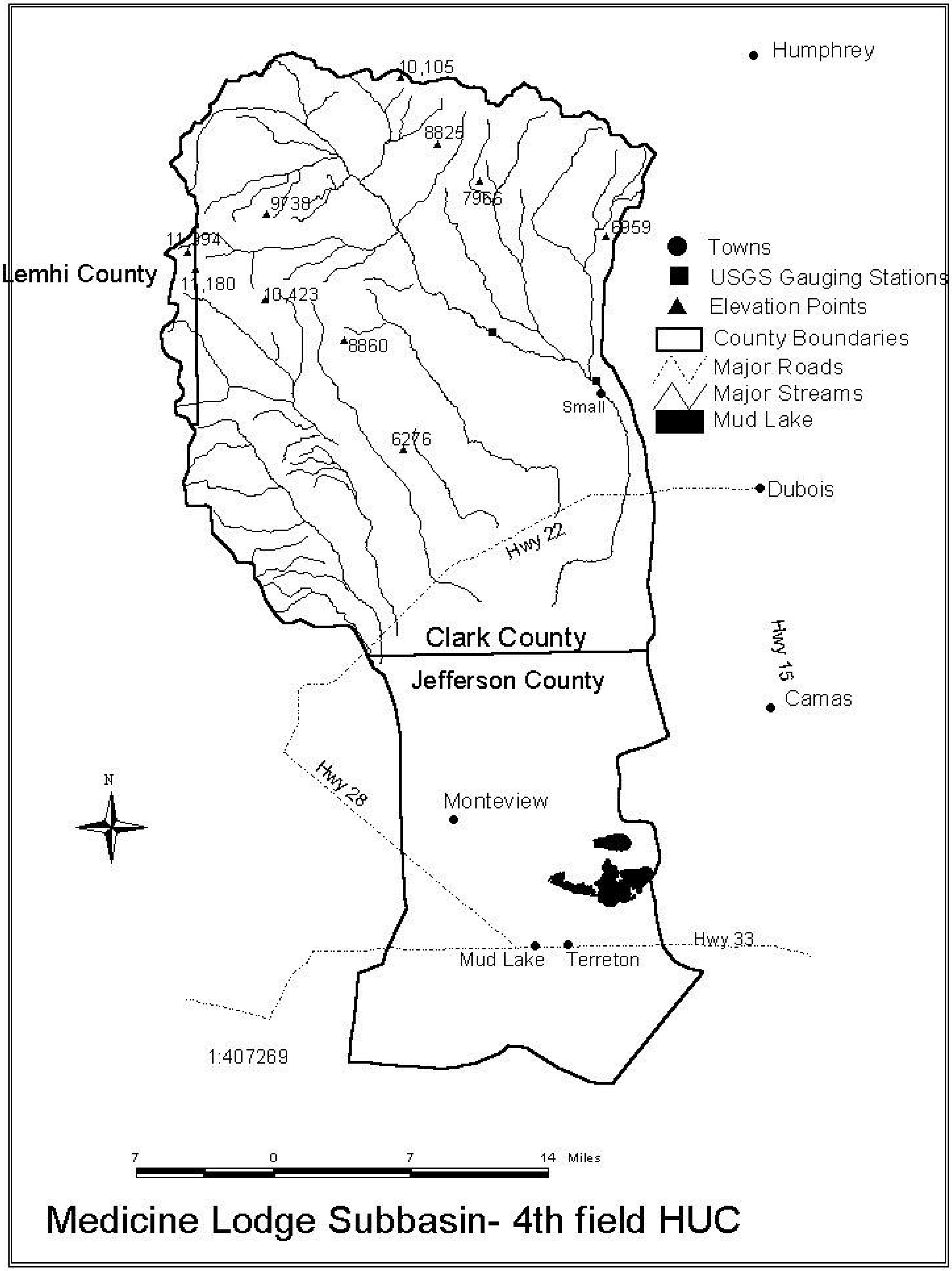

Figure 2. Medicine Lodge Watershed

Table 1. Summary of climate data collected from January 1, 1925 to April 30, 2000 at Dubois, Idaho

Period	Average Max Temp (F)	Average Min Temp (F)	Average Mean Temp (F)	Highest Average Temp (F)	Lowest Average Temp (F)	Average Total Snowfall (in)	Average Total Precipitation (in)
January	27.0	10.2	18.5	30.7	3.0	10.6	0.77
February	32.0	14.1	23.0	34.2	9.6	9.0	0.74
March	39.9	20.4	30.2	44.8	20.0	5.6	0.76
April	54.4	29.8	42.1	52.2	31.4	2.1	0.96
May	65.3	38.3	51.8	60.8	46.2	0.9	1.69
June	74.1	44.9	59.5	66.4	53.5	0.1	1.80
July	85.1	52.1	68.6	73.3	58.0	0.0	0.86
August	83.6	50.4	67.0	72.1	61.0	0.0	0.94
September	72.6	42.1	57.3	63.8	49.2	0.1	0.90
October	58.4	32.8	45.6	54.1	37.3	1.3	0.82
November	39.8	21.7	30.7	39.4	20.7	6.3	0.90
December	29.6	13.1	21.4	28.6	10.1	11.8	0.89
Annual	55.2	30.8	43.0	48.9	38.5	47.9	12.03

Source: Western Regional Climate Center @ http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?iddubo

Subbasin Characteristics

Hydrography/Hydrology

Medicine Lodge Creek, the largest creek in the drainage, flows approximately 21.24 stream miles in a southeasterly direction. Medicine Lodge Creek begins at the confluence of Warm Creek and Fritz Creek and flows through a mixed geology of loess and basalt.

The Medicine Lodge watershed is a closed system. The tributaries that reach Medicine Lodge Creek contribute to the flow, but some do not reach it year round due to infiltration and diversions. Medicine Lodge Creek does not continue far past Small, ID due to loss through the soil and diversion for agriculture. There are also sub-watersheds to the west of Medicine Lodge that never reach the main stream, but are still contained in the 4^{th} field hydrologic unit code. The 4^{th} field HUC is a watershed classification system designed by the USGS separating areas by watershed boundaries. The 4^{th} field HUCs may be further specified into 5^{th} and 6^{th} field HUCs as they get progressively smaller in area. Crooked Creek, Warm Springs Creek and Deep Creek all parallel Medicine Lodge Creek in sub-watersheds to the west. These creeks all sink before they reach another water body.

The streams in the drainage are composed of two main types. The majority of streams flow due to runoff from rainfall and snowmelt from the surrounding mountains and while Warm Springs Creek and Warm Springs are both from natural thermal springs. (BLM 2001)

Current hydrologic conditions differ from historic conditions.

> "Based on historical accounts and personal communications, many of the tributary streams to Medicine Lodge Creek long ago had extensive beaver dam complexes and ponds that provided abundant fishing opportunities. Today the hydrologic regime is altered with these streams experiencing downcutting and gullying, with a lower water table stressing and reducing remnant riparian-wetland vegetation. Beaver removal, dredging and draining of wetlands, irrigation withdrawals, improper grazing and natural, high flow events have all contributed to the present condition. This present condition of the stream channel compared to the earlier prevalence of beaver-dominated systems, is still affecting the hydrologic regime and sediment delivery." (BLM 2001)

The United States Geological Survey (USGS) has had two gauging stations in the Medicine Lodge Drainage. Table 2 lists the gauging stations and Figure 2 shows their locations. Station number 13116000 was located at the Ellis Ranch on Medicine Lodge Creek above the confluence of Middle Creek while station number 13116500 was located near Small, ID. Neither station is currently active.

Table 2. USGS Gauging Station

Station Number	Station Name	Drainage Area (mi^2)	Elevation ft above National Geodetic Vertical Datum or (NGVD)	Period of record
13116000	Medicine Lodge Creek at Ellis Ranch	165 mi^2	5710	1940-1969
13116500	Medicine Lodge Creek at Small, ID	270 mi^2	5480	1921-23, 1941-49, 1985-96, 1997-99

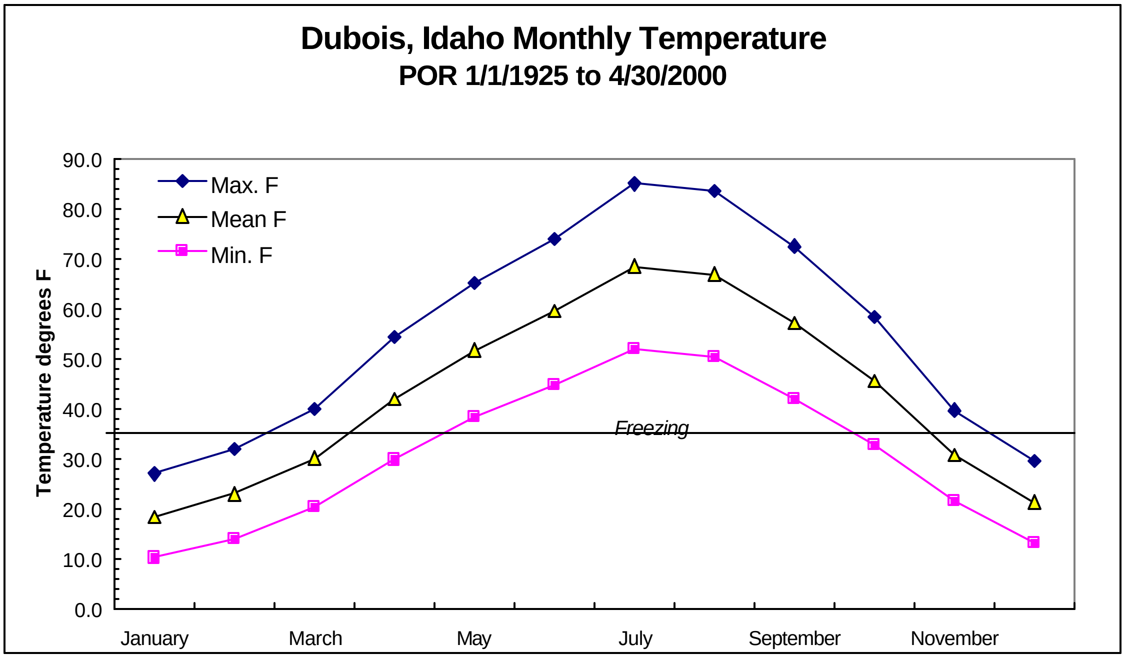

Figure 3. Average monthly temperature for Dubois, ID

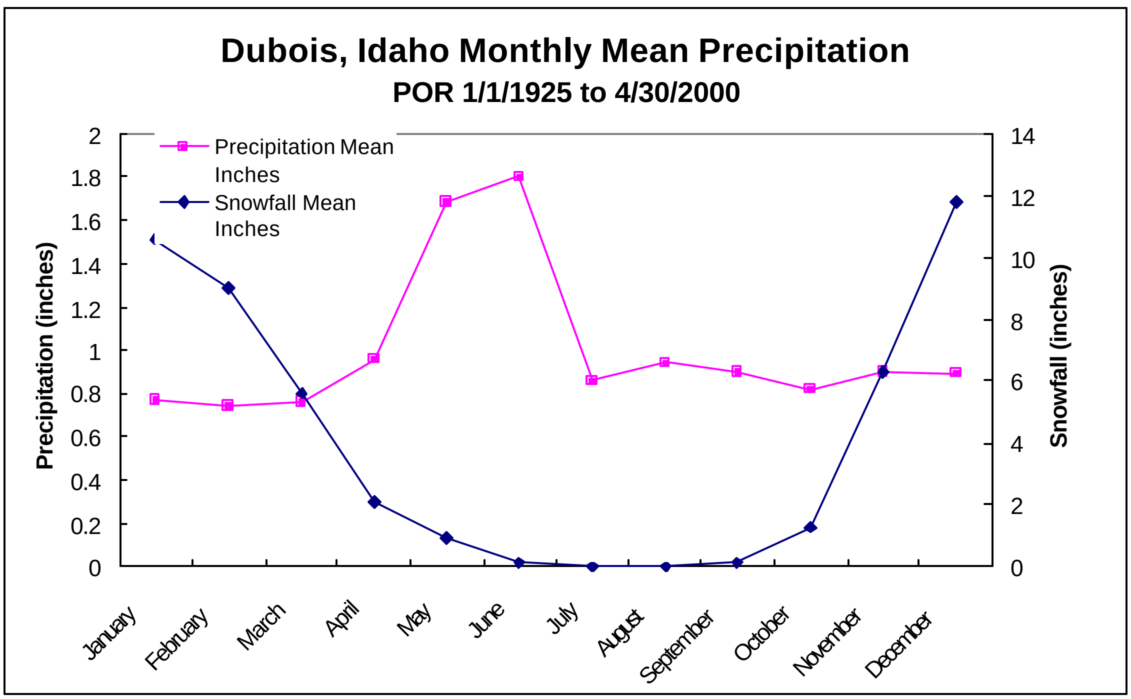

Figure 4. Average monthly precipitation for Dubois, ID

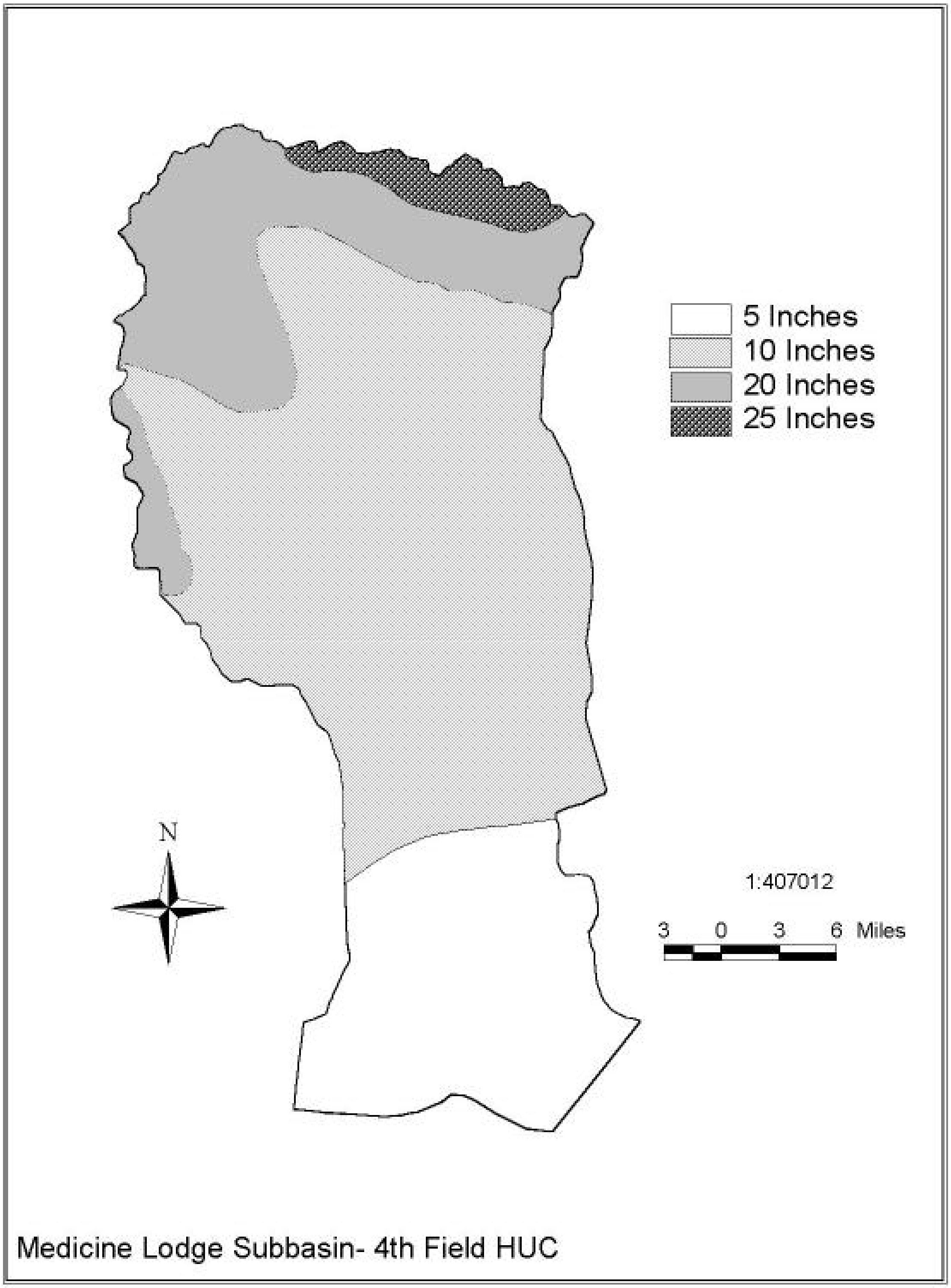

Figure 5. 1995 Precipitation

Geology

The Bureau of Land Management (BLM 2001) provided the following geologic description. See Figure 6 for a map of Medicine Lodge Subbasin geology.

> The Medicine Lodge Subbasin includes portions of the Northern Rocky Mountain physiographic province and the Eastern Snake River Plain section of the Colombia Intermontane physiographic province. The boundary between these provinces is characterized by the distinctive rise in topography that is evidenced north of Lidy Hot Springs, Winsper, and Small.
>
> The Northern Rocky Mountain physiographic province is characterized by a number of mountain ranges and intervening valleys that have developed on the Idaho batholith and other subsidiary igneous intrusions. These mountain ranges, which include the Beaverhead Range in the northern portion of the Subbasin, consist of metamorphic and sedimentary rocks of Precambrian to Mesozoic age that have been subjected to intensive uplifting, faulting, and folding. Within the Subbasin, most of these deformed metamorphic and sedimentary units have been covered with a veneer of volcanic rhyolite, basalt, and welded tuff that are known locally as the Edie School Rhyolite and the Medicine Lodge Volcanics.
>
> In the late Cenozoic Era, during the later stages of the building of the mountain ranges of the Northern Rocky Mountain province, the mountain province was dissected by an extensive rifting in the earth's crust which created a broad trough that filled with volcanic rocks. This trough, which extends in an arcuate pattern across southern Idaho, is known as the Snake River Plain. The basalt flows that underlie the Snake River Plain are many thousands of feet thick. Volcanic vents or eruptive centers such as Cedar Butte, Camas Butte, and Table Butte are common in the southern third of the Subbasin. Over much of the southern portion of the subbasin, the basalt has been covered with a veneer of wind blown sediments. In the Mud Lake/Terreton area, the basalt has been covered with lake sediments left behind as the Pleistocene age Lake Terreton evaporated, leaving Mud Lake as its remnant. Figure 6 displays the dominant geology types in the watershed.
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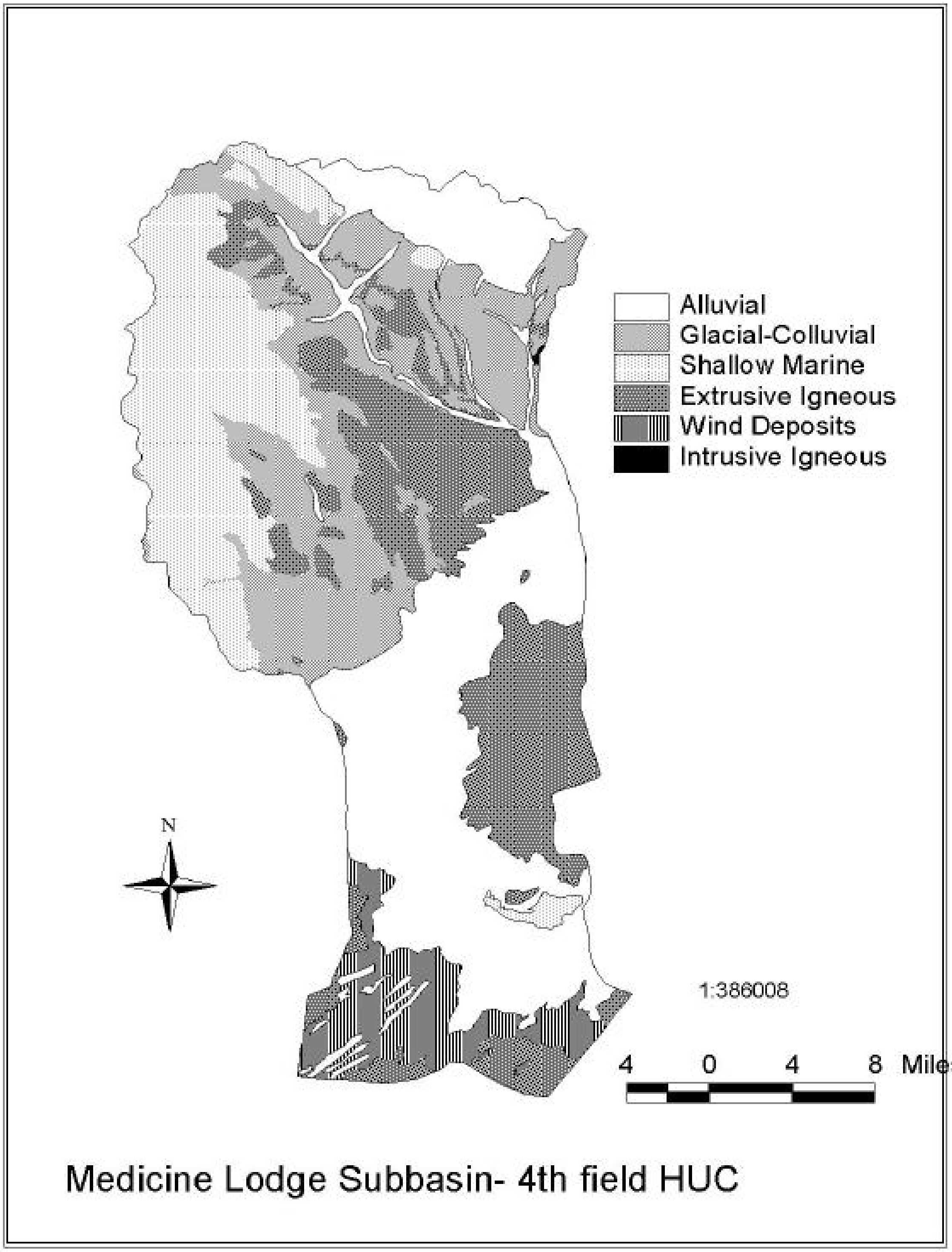


Figure 6. Geology of the Medicine Lodge Watershed

Soils

The soils in the Medicine Lodge Subbasin vary dramatically as does the topography. The watershed borders the continental divide and moves down into the valley where the soil depth increases and the slope decreases. Basalt canyons and cliffs are found interspersed throughout the watershed with steep mountains along the continental divide. The majority of the soils in the Medicine Lodge Subbasin are predominantly composed of sand, loam and gravel.

The Map Unit Identification Numbers (MUID) along with a summary of the soil types for this area are shown in Table 3. The location of the MUID areas is shown in Figure 7. This is based on STATSGO data (NRCS 2000) and from the NRCS's STATSGO COMP and LAYER database files (NRCS 2000). STATSGO is the State Soil Geographic database that has been compiled by the National Cooperative Soil Survey (NCSS) and is led by the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). STATSGO is compiled by generalizing more detailed soil maps. Map unit composition for a STATSGO map is determined by transecting or sampling areas on the more detailed maps and expanding the data statistically to characterize the whole map unit (NRCS 2000).

The summary of the STATSGO data found in Table 3 contains average soil slope, soil depth and the average K factor (Hoover 2000). These are weighted averages for the entire polygon of the MUID.

K-factor is a measure of erodibilty used in the Universal Soil Loss Equation. It measures the tendency of a soil to erode based on the soil texture, organic matter content, soil structure and permeability. The soil is given a score from 1.0 to 0.1, where 1 is extremely erosive and 0.1 is nearly non-erosive. Soils in the subbasin have a fairly low to moderate K-factor with none over 0.3 (Figure 8). The majority of the soils that are in the drainage area are between 0.1 and 0.15. Within the entire subbasin, the most erosive soils are found in the area south of the streams in the lower section of the HUC where Mud Lake is located. The most non-erosive soils are found along the continental divide, which is also where the highest elevations and the shallowest soils are found.

Soil slope is another factor in assessing the erodibilty risk of a system. The soil slope data was also gathered from the NRCS's STATSGO database and given as a weighted average (Figure 9). As expected, the greatest slopes were found along the continental divide in the north and west sides of the watershed. The slope generally decreases down into the valley to a 0-3% range, although there are some variations. The headwaters of the Medicine Lodge drainage system begins at Divide Creek where the slope is greater than 44%, but decreases to between 17% and 34% before joining with Warm Creek and Fritz Creek becoming Medicine Lodge Creek. Medicine Lodge Creek flattens to between 9% and 17% below

Spring Hollow and again decreases to between 3% and 9% below the confluence with Indian Creek.

The depth of soil in the subbasin is depicted in Figure 10. The deepest soils, greater than or equal to 60 in, are found primarily in the southern third of the subbasin near Mud Lake.

Table 3. Medicine Lodge Subbasin STATSGO soil summary

MUID	Acres	Sq Mi.	Name	Avg Slope (%)	Avg K Factor	Avg Depth (in)	Soil Texture (Surface)
ID114	256.471	0.4	Bereniceton-Diston-Grassy Butte-Dune Land-Rock Outcrop-Modkin	15.97	0.13	45.71	Sand (46%), very stony-loam (26%). Some loamy sand, clay loam, unweathered bedrock, and sandy loam.
ID115	11,062.39	17.285	Grassy Butte-Diston-Rock Outcrop-Malm-Matheson-Lidy-Zwiefel	7.485	0.11	50.91	Loamy sand (53%), 19% sand. Some extremely stony-loamy sand, unweathered bedrock, sand loam, fine sand and extremely stony-sandy loam.
ID134	97,934.66	153.023	Montlid-Fluvaquents-Terreton-Zwiefel	0.565	0.26	60.00	Sandy loam (79%), loamy sand (13%). Some clay loam and silty clay.
ID135	11,190.65	17.486	Levelton-Fluvaquents-Terreton-Zwiefel	0.815	0.25	60.00	Loamy sand (31%), loam (30%). Some sandy loam, silty clay, and fine sand.
ID137	11,071.60	17.299	Aecet-Bereniceton-Terreton-Bondfarm-Malm-Pancheri-Rock Outcrop	17.225	0.18	37.73	Very stony-loam (43%), unweathered bedrock (26%), silt loam (13%). Some loam, sandy loam, loamy sand, stony-silt loam and silty clay loam.
ID138	5,896.30	9.212	Aecet-Grassy Butte-Malm-Matheson-Rock Outcrop-Terreton	8.85	0.17	40.00	Loamy sand (60%), very stony-silt loam (13%), and silty clay loam (12%).
ID140	67,283.15	105.13	Bereniceton-Harston-Medicine-Mccaleb-Whiteknob-Packham-Lidy-Matheson	3.015	0.21	57.86	Gravelly-loam (47%), loam (44%). Some clay loam, silty loam and very gravelly-loam.

MUID	Acres	Sq Mi.	Name	Avg Slope (%)	Avg K Factor	Avg Depth (in)	Soil Texture (Surface)
ID160	36,977.31	57.777	Paint-Simeroi-Whitecloud	5	0.12	60.00	Gravelly loam (96%) and some very gravelly loam.
ID164	35,342.81	55.223	Crystal Butte-Fourme-Judkins-Stringam-Sudpeak-Targhee-Tineman	13.565	0.20	52.50	Gravelly loam (52%), loam (46%), and some silty loam.
ID165	37,347.44	58.355	Aecet-Atomic-Bondfarm-Malm-Matheson-Rock Outcrop	9.465	0.19	29.17	Silty loam (39%), fine sandy loam (36%), loam (15%), and unweathered bedrock (10%).
ID172	82,244.68	128.507	Fritz-Hagenbarth-Latigo-Parkalley-Poso-Rubble Land-Windicreek-Zeebar	25.975	0.14	58.57	Gravelly loam (78%), Gravelly-silt loam (12%). Some extremely gravelly-loam and fragmented material.
ID178	126,006.01	196.884	Custco-Deadhorse-Deecree-Horseridge-Latigo-Mogg-Rock Outcrop-Shagel-Small-Truble-Westindian-Zeebar-Zer	15.67	0.15	44.00	Gravelly-silty loam (35%), silt loam (30%), gravelly-loam (14%). Some unweathered bedrock, extremely stony-loam, and gravelly loam.
ID184	15,302.28	23.91	Rock Outcrop-Rubble Land-Cryoborolls-Typic Cryorthents	52.425	0.03	22.50	Unweathered bedrock (40%), fragmented material (25%), stony-loam (25%), and some variable.
ID194	43,190.68	67.485	Cryoborolls-Cryochrepts-Koffgo-Lag-Rock Outcrop-Rubble Land	52.395	0.05	42.50	Very stony-loam (34%), fragmented material (22%), unweathered bedrock (21%). Some stony-loam, cobbly-loam, very gravely-loam, and very cobbly.

Slopes, K factor and depth are weighted averages.

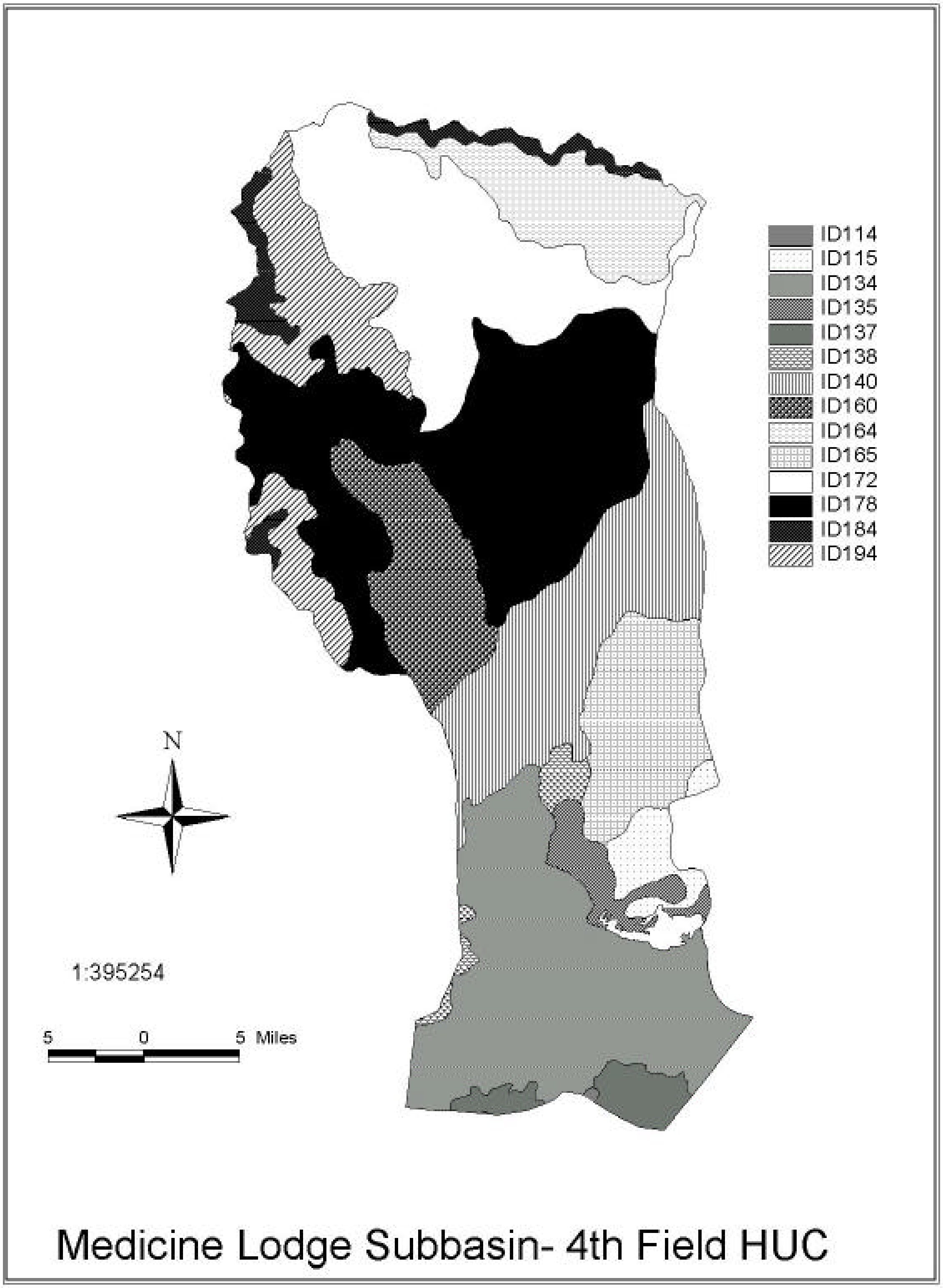


Figure 7. STATSGO Soil Map Unit Identifications

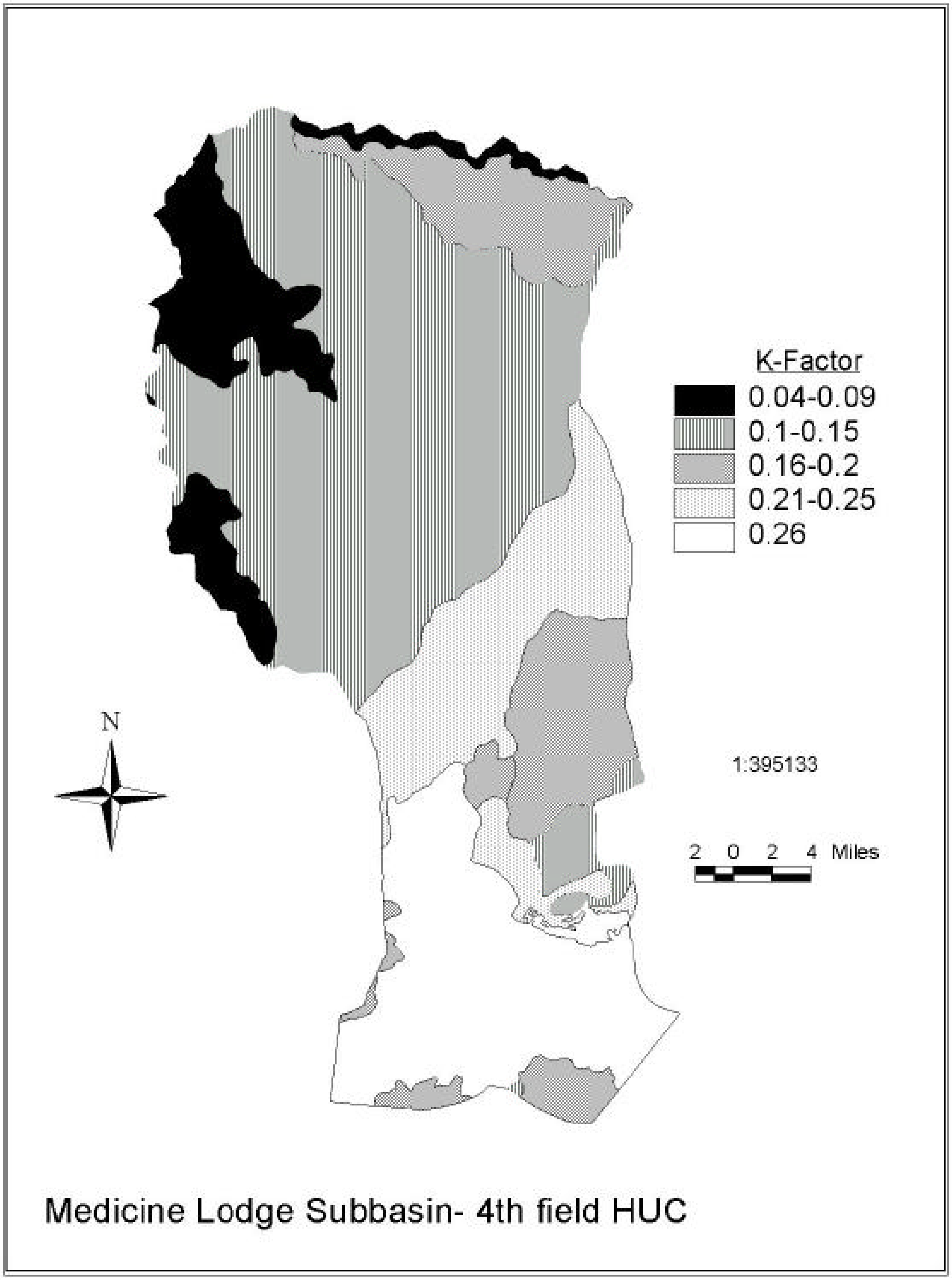


Figure 8. Soil Erosion Potential

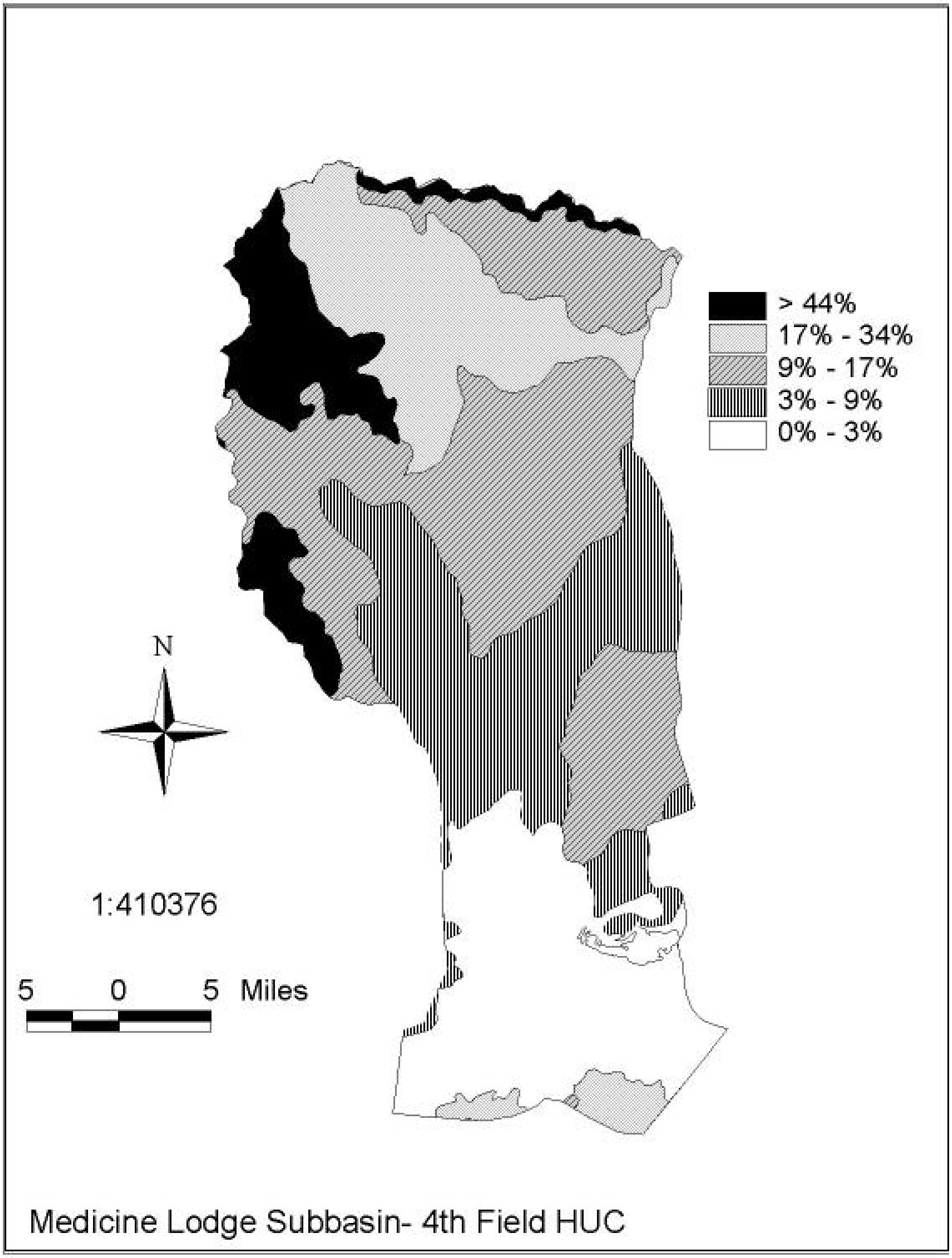


Figure 9. Soil Slope

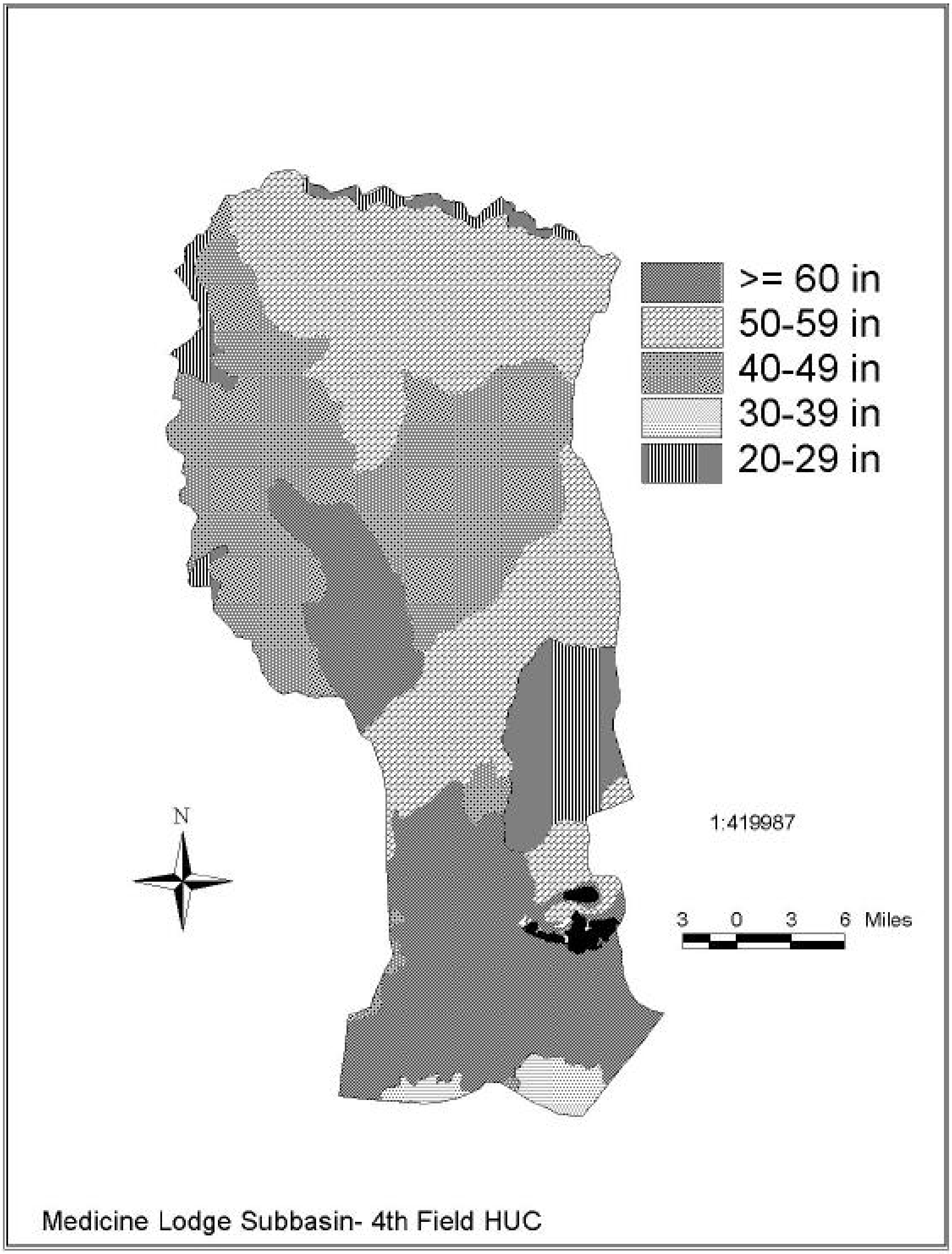


Figure 10. Soil Depth

Fisheries

The Medicine Lodge drainage is a closed drainage disconnected to adjacent drainages by ancient geologic formations. In addition to Medicine Lodge Creek and its tributaries, there are several sub-watersheds to the west included in this assessment, including Deep Creek, Warm Springs Creek and Crooked Creek (see Figure 2). Currently there are three species of salmonids in the Medicine Lodge Drainage. These include Yellowstone cutthroat (*Oncorhynchus clarki*), brook trout (*Salvelinus fontinalis*) and rainbow trout (*Oncorhynchus mykiss*). Although brook trout and rainbow trout have been introduced, there is debate over the origination of the Yellowstone cutthroat in the drainage.

The Idaho Department of Fish and Game stocked rainbow trout from 1968 through 1982. They typically introduced between 1000 to 2500 pounds of rainbow trout every year (Figure 11). There are no stocking records for brook trout.

The controversy over the Yellowstone cutthroat occurs for several reasons. In a report for the USGS of Montana in 1872, F.V. Hayden described the Medicine Lodge drainage as such, "I think I never saw a stream, large or small, more fully crowded with trout. There were two species, each equally abundant; and yet this stream sinks beneath the surface and is lost entirely twenty-five miles before reaching Snake River." This report shows that there were large amounts of salmonids in the drainage early in our settlement history. If settlers had introduced the fish, it is hard to believe that they had become so abundant in such a short period of time, so it stands to reason that there was some type of salmonid in the drainage prior to European settlement of the area. With this information, it is generally assumed that the Yellowstone cutthroat is an indigenous species to the Medicine Lodge drainage and has been managed as a wild trout fishery (Figure 12).

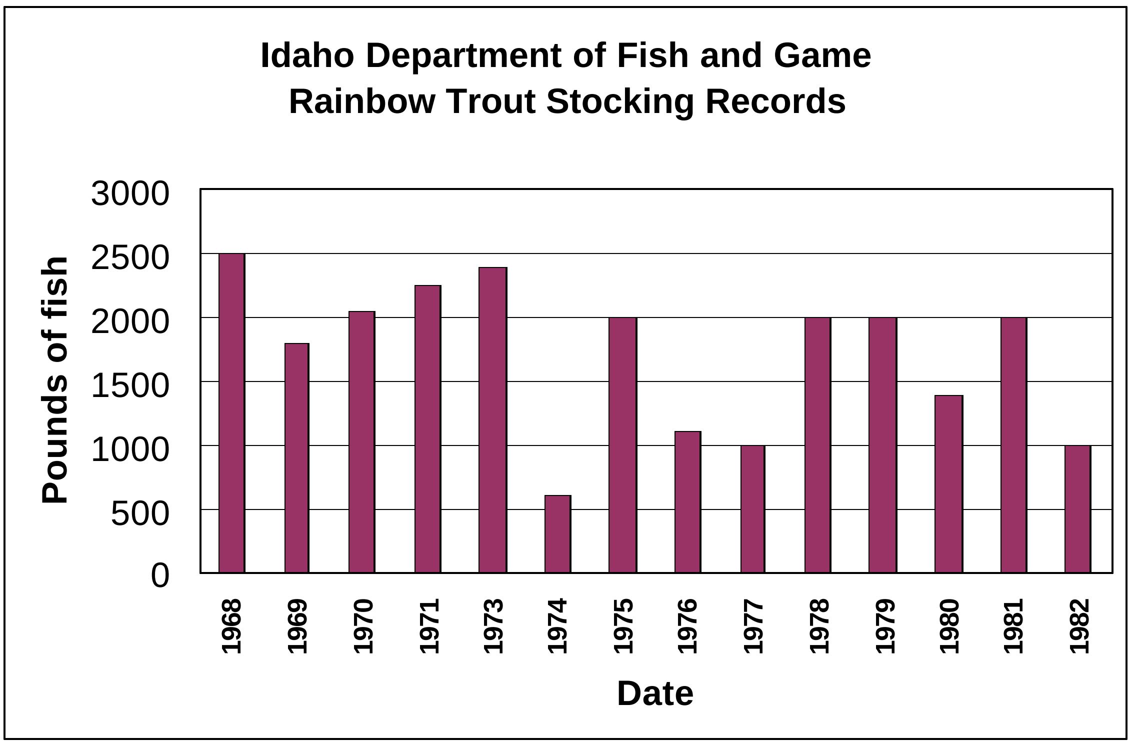
The Yellowstone cutthroat is considered a state sensitive species in Idaho and is carefully managed by the Idaho Department of Fish and Game. In 1998 it was petitioned to become a threatened species, but after review in February, 2001, the U.S. Fish and Wildlife Service declined the petition to list the Yellowstone cutthroat under the Endangered Species Act.

The population of the Yellowstone cutthroat in the drainage has been depressed in part as a result of the rainbow trout and brook trout populations. Rainbow trout pose a challenge due to their ability to hybridize with the Yellowstone cutthroat creating a population of impure genetics. Brook trout are also a challenge for the Yellowstone cutthroat due to competition. These fish are very unlikely to live together since brook trout generally have more success in breeding and competing for space.

Hybridization has been documented between rainbow trout and Yellowstone cutthroat trout in every stream in the HUC except for Crooked Creek and the west fork of Irving Creek. The presence of a pure Yellowstone cutthroat population in Crooked Creek is documented only by the USFS data. The USFS practices at that time did not include the measuring of fish caught, so there is no way to determine the age classes of Yellowstone cutthroat for this stream with the current data. Crooked Creek is a closed system without a documented presence of rainbow trout, which has most likely allowed the group to remain genetically pure. The west fork of Irving Creek was also fished without sign of hybridization although hybrids were found in the lower stem of the creek.

Medicine Lodge Creek also contains non-salmonid species of fish, including the short-headed sculpin (*Cottus confusus*) which are found in the majority of the tributaries as well as the main stem of Medicine Lodge Creek. Western mosquito fish (*Gambusia affinis*), a warm water species, have also been found in Warm Springs Creek and have obviously been introduced although there are no records of this.

Figure 11. Idaho Fish and Game Rainbow Trout Stocking Records



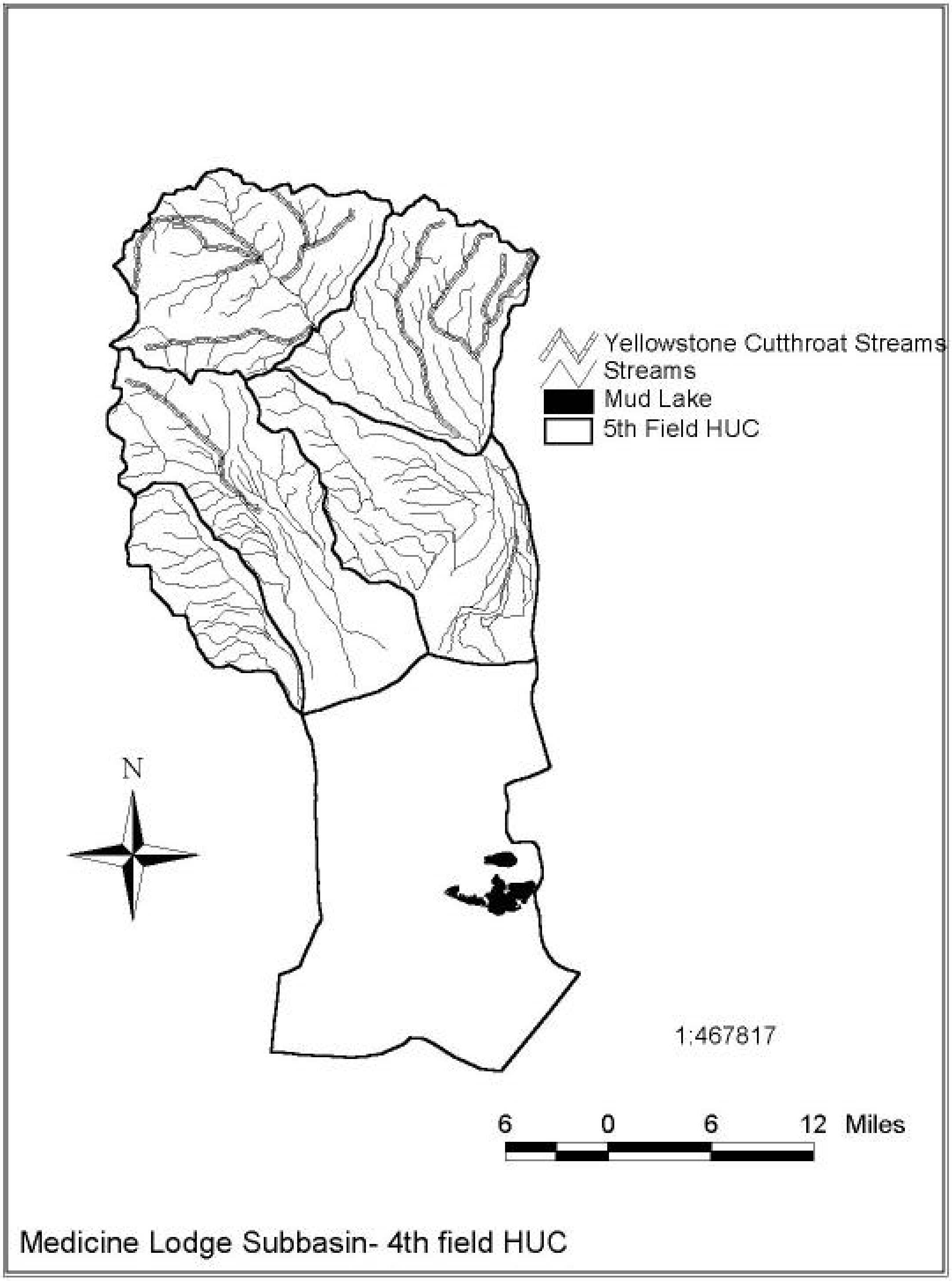


Figure 12. Yellowstone Cutthroat Trout Distribution

Sub-Watershed Characteristics

The Medicine Lodge Subbasin has six sub-watersheds. These are also the fifth field hydrologic units defined by the USGS. The fifth field HUCs are shown in Figure 13 and their attributes are summarized in Table 4. The relief ratio has been calculated for each sub-watershed by taking the difference in elevation between the high point on a watershed divide and its pour point divided by the length of the watershed. A relief ratio of zero indicates that the watershed is completely flat and has no erosive power. The Mud Lake sub-watershed is the closest to a "flat" situation, with a relief ratio of 0.004. The sub-watershed with the highest relief ratio is the Divide Creek watershed which borders the continental divide.

The drainage density provides a relative measure of transport efficiency as well as a measurement of the average spatial diversity of a stream system. It is calculated by dividing the total length of streams by the land area. The drainage density for the Mud Lake sub-watershed is given a zero because there are no stream channels in this area, only drainage canals. The highest drainage density in the watershed is in the Medicine Lodge Creek sub-watershed with 1.278 miles of stream for every square mile of area.

For comparable geology and soils, a watershed with greater relief ratio and drainage density would tend to have a greater natural sediment yield as well as higher potential for accelerated erosion due to land surface disturbances.

Table 4. Physical attributes of 5th field HUCs in the Medicine Lodge Subbasin

HUC5 Name	**Area (mi^2)**	**Total # of stream miles**	**Dominant Aspect**	**Elevation Range**		**Relief Ratio**	**Drainage Density (mi/mi^2)**
				Pour Point	**High Point in watershed**		
Chandler Canyon	57.9	70.21316	SE	4862 ft	9877 ft	0.060	1.213
Divide Creek	134.5	134.0186	SE	6198 ft	10963 ft	0.074	0.996
Indian Creek	124.5	128.5036	S-SE	5517 ft	9166 ft	0.045	1.032
Medicine Lodge Creek	146.1	186.6795	SE	4861 ft	8426 ft	0.029	1.278
Mud Lake	297.1	0	S	4700 ft	5200 ft	0.004	0
Warm Springs Creek	153.9	152.1972	SE	4832 ft	11284 ft	0.049	0.989

Drainage density is based on 1:100k GIS hydrography, excluding canals

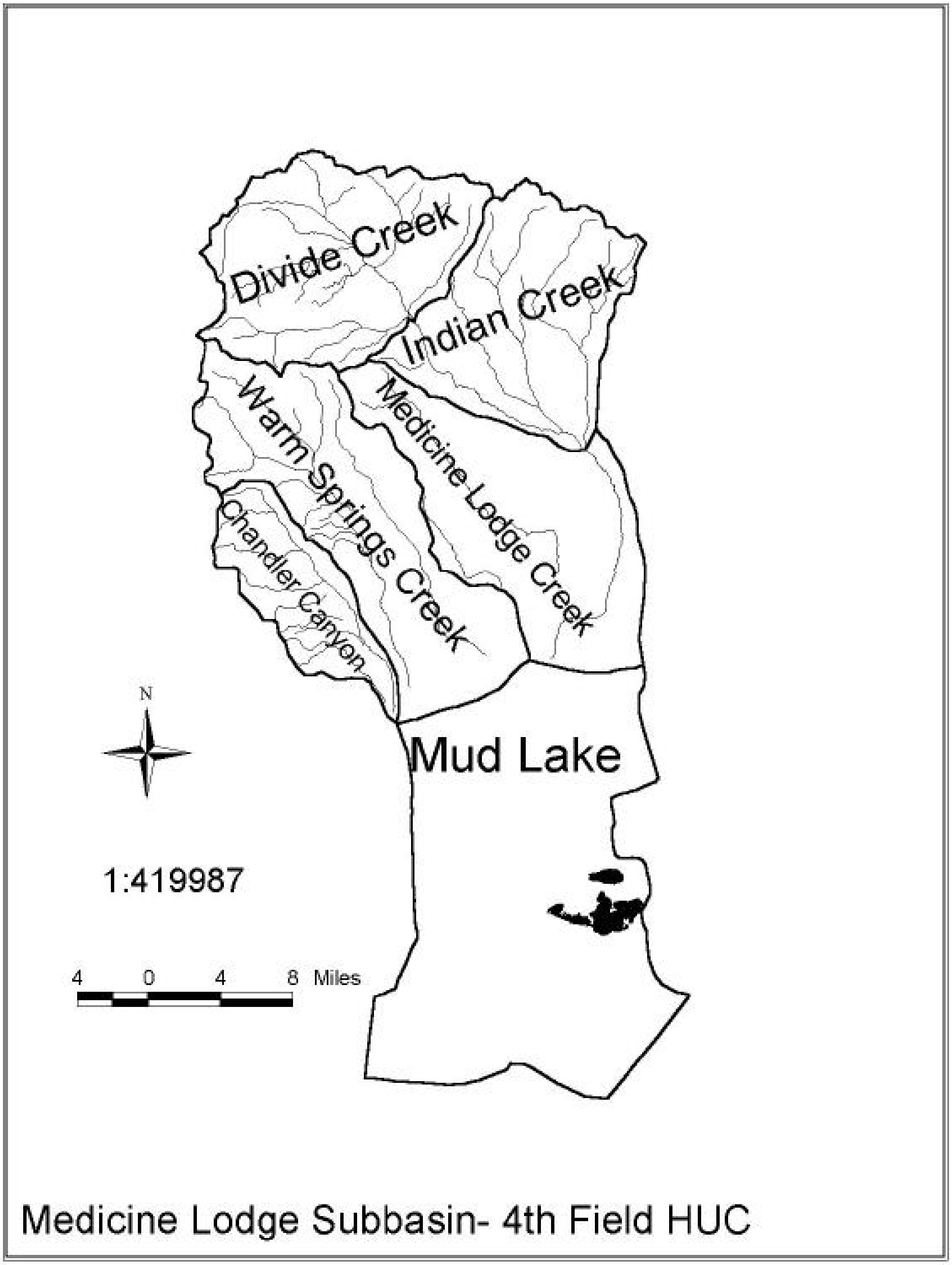


Figure 13. 5th Field Watersheds

Stream Characteristics

The geomorphic characteristics of the streams in the Medicine Lodge Subbasin vary considerably. Table 5 contains a summary of the subbasin's geomorphic characteristics. Much of the data for this table was collected from the DEQ BURP (Beneficial Use Reconnaissance Program). The overall stream gradient was calculated from 1:100,000 scale hydrographic GIS coverage. The valley and channel classifications are based on Rosgen and were compiled from the DEQ BURP data.

Table 5. Geomorphic Characteristics of streams in the Medicine Lodge Subbasin

Stream	WBID No.	HUC5 Name	Valley Type	Rosgen Channel Type	Overall Stream Gradient (%)	Dominant Substrate	Avg. Width/ Depth ratio
Crooked Creek	21	Warm Springs Creek	U-shaped	G	3.0	silt/clay	20
Deep Creek	18	Medicine Lodge Creek	U-shaped	B	1.0	silt, sand	21
Divide Creek	14	Divide Creek	Trough-like	B	2.0	silt/clay	47
Dry Creek	9	Indian Creek	U-shaped	C	3.0	coarse pebble, small cobble	22
Edie Creek, at BLM	10	Divide Creek	Trough-like	B	3.0	silt, small cobble	
Edie Creek, lower	10	Divide Creek	Flat-bottom	B	4.0	silt/clay	44
Fritz Creek, lower	16	Divide Creek	Flat-bottom	F	1.0	silt, sand	
Fritz Creek, S. Fork	16	Divide Creek	U-shaped	B	3.0	silt, coarse pebble	18
Fritz Creek, upper	16	Divide Creek	Trough-like	B	2.5	silt/clay	
Fritz Creek, N. Fork	16	Divide Creek	U-shaped	B	3.0	silt/clay	44
Horse Creek, lower	15	Divide Creek	U-shaped	G	2.5	silt/clay	17
Horse Creek, upper	15	Divide Creek	Trough-like	F	3.0	coarse pebble	19
Indian Creek	3	Indian Creek	Flat-bottom	F	0.5	coarse pebble	12
Indian Creek, W. Fork	5	Indian Creek	U-shaped	B	3.5	coarse pebble, small cobble	17
Irving Creek, E. Fork	12	Divide Creek	Flat-bottom	B	3.0	silt, coarse pebble	14
Irving Creek, lower	12	Divide Creek	Flat-bottom	C	3.0	silt, coarse pebble	

Steam Name	WBID No.	HUC5 Name	Valley Type	Rosgen Channel Type	Overall Stream Gradient (%)	Dominant Substrate	Avg. Width/ Depth ratio
Irving Creek, upper	12	Divide Creek	U-shaped	C	2.5	silt, coarse pebble	18
Medicine Lodge Creek	2	Medicine Lodge Creek	Trough-like	B	2.0		
Medicine Lodge Creek	6	Medicine Lodge Creek	Flat-bottom	B-C	2.0		16
Medicine Lodge Creek	11	Divide Creek	U-shaped	F	2.0	silt, coarse pebble	
Middle Creek	7	Indian Creek	Box Canyon	C	3.5	silt, coarse pebble	26
Middle Creek	8	Indian Creek	U-shaped	A	3.0	coarse pebble, small cobble	9.1
Myers Creek	21	Warm Springs Creek	U-shaped	B	3.0	silt, coarse pebble	13
Warm Creek, lower	13	Divide Creek	Flat-bottom	F	0.9	silt/clay	
Warm Creek, upper	13	Divide Creek	Trough-like	B	1.6	silt/clay	
Warm Springs Creek, lower	20	Warm Springs Creek	Box Canyon	E	0.9	silt/clay	
Warm Springs Creek, upper	20	Warm Springs Creek	Box Canyon	C	1.0	silt/clay	
Webber Creek, lower	17	Divide Creek	U-shaped	B	2.0	silt, coarse pebble	48
Webber Creek, upper	17	Divide Creek	V-shaped	B	2.5	silt, coarse pebble	17
Wood Canyon Creek	8	Indian Creek	U-shaped	A	4.0	silt/clay, sand	12

References: Valley and channel type based on Rosgen 1993
Overall stream gradient calculated from GIS hydrography coverage
Dominant substrate and width/depth ratio compiled from DEQ BURP data

1.3 Cultural Characteristics

The area in the Medicine Lodge Subbasin is primarily agriculture with a very low population density. The majority of the watershed is in Clark County (Figure 2). The southern half of the subbasin is in Jefferson County.

The Medicine Lodge Subbasin's economy is primarily agriculture. The BLM and USFS have grazing allotments within the subbasin. The BLM manages 28 allotments with a total of 31,713 animal unit months (AUM) while the USFS has 13 grazing allotments with 17,957 AUMs. Much of the private land is also grazed. The public and private lands are grazed with sheep, cattle and buffalo. (Mickelson 2001)

The counties also produce field crops. The National Agricultural Statistics Service reported that Clark County produced 214,000 production bushels of Barley harvested off of 2300 acres of land. In Jefferson County there were 4,404,000 production bushels of Barley and 810,000 bushels of oats. (NASS 2000)

Land Use

The land in the Medicine Lodge Subbasin is 69% rangeland (Figure 14). Another 23% is agriculture with 7% forest. The forested area is found in the western part of the subbasin in the headwaters of Fritz Creek, Webber Creek and Crooked Creek. The majority of the agricultural land is found in the southern part of the subbasin which is primarily flat and devoid of much hydrography.

Road densities in Medicine Lodge are very low. Idaho Highway 22 cuts across the subbasin south of Small, ID and Highway 28 and 33 cross in the southern section. There are county and private roads throughout the subbasin. The road along Medicine Lodge Creek is paved (with patches unpaved) while the rest of the roads in the subbasin are unpaved.

Table 6. Land use in the Medicine Lodge Subbasin (Anderson Level I).

Land Use Category	Acres	Square Mi.	Square Km.	% of Total
Forest	44,712	70	181	7%
Irrigated-Gravity Flow	74,959	117	303	12%
Irrigated-Sprinkler	64,936	101	263	11%
Rangeland	418,672	654	1,694	69%
Total	**603,279**	**942**	**747**	**100%**

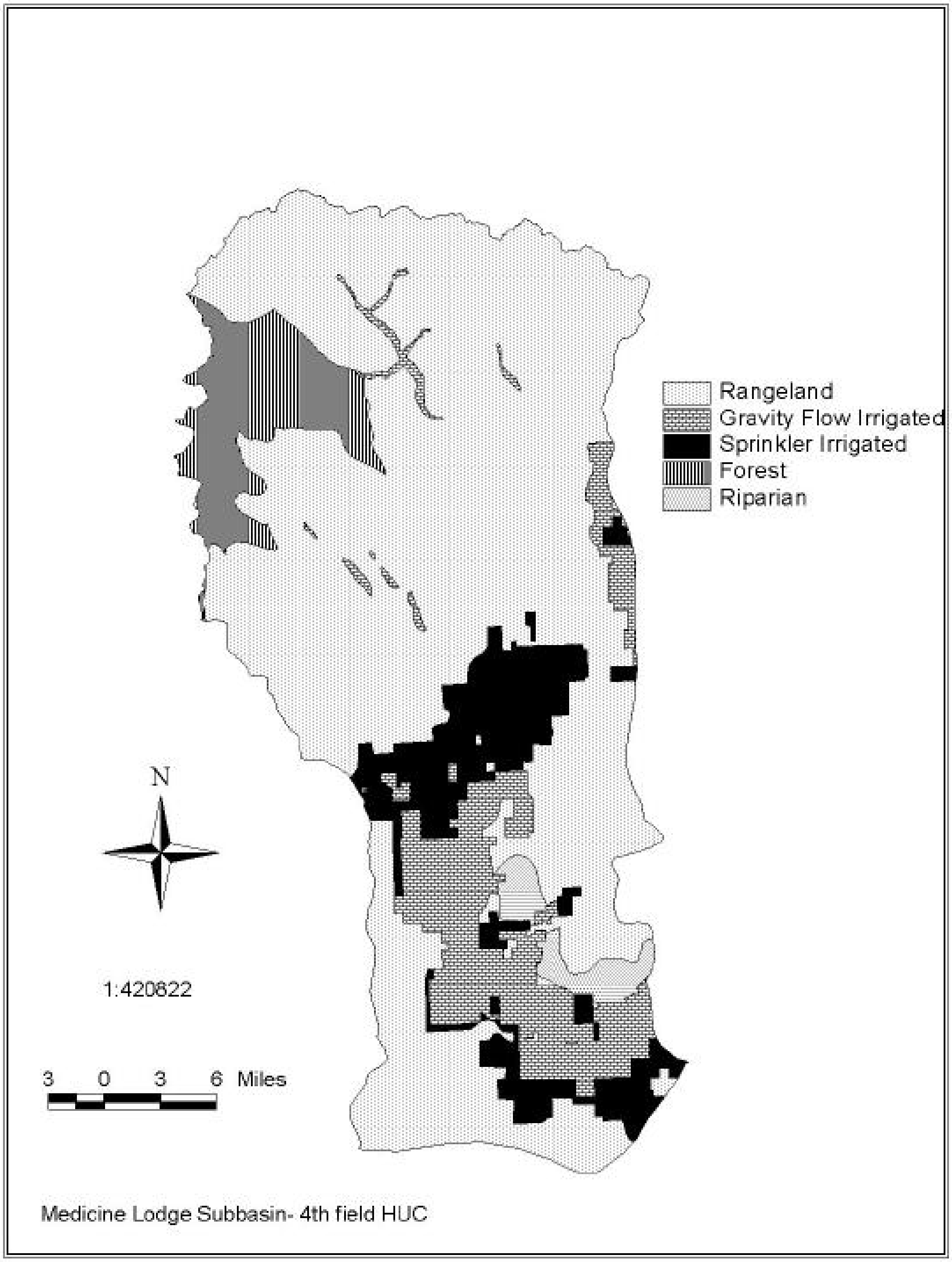


Figure 14. Land Use in the Medicine Lodge Subbasin

Land Ownership

The majority (69%) of the Medicine Lodge Subbasin is public land. The BLM manages 33% while the USFS manages 25%. The State of Idaho (Idaho Department of Lands) manages small land parcels interspersed throughout the BLM land totaling 4% of the watershed. 31% of the subbasin is owned privately, most of which lies in the southern half of the subbasin. The Idaho National Environmental Engineering Laboratory's boundaries enter the subbasin in the southwestern tip (7%).

Table 7. Land ownership in the Medicine Lodge Subbasin

Description	Acres	Square Miles	Square Km	% of Total
Private	**182,613**	**285**	**739**	**31%**
Public				
B.L.M.	192,346	300	778	33%
Department of Energy	39,617	62	160	7%
State of Idaho	20,930	33	85	4%
U.S. Forest Service	146,205	228	591	25%
Subtotal	**399,098**	**623**	**1,615**	**69%**
Total	**581,711**	**909**	**2,353**	**100%**

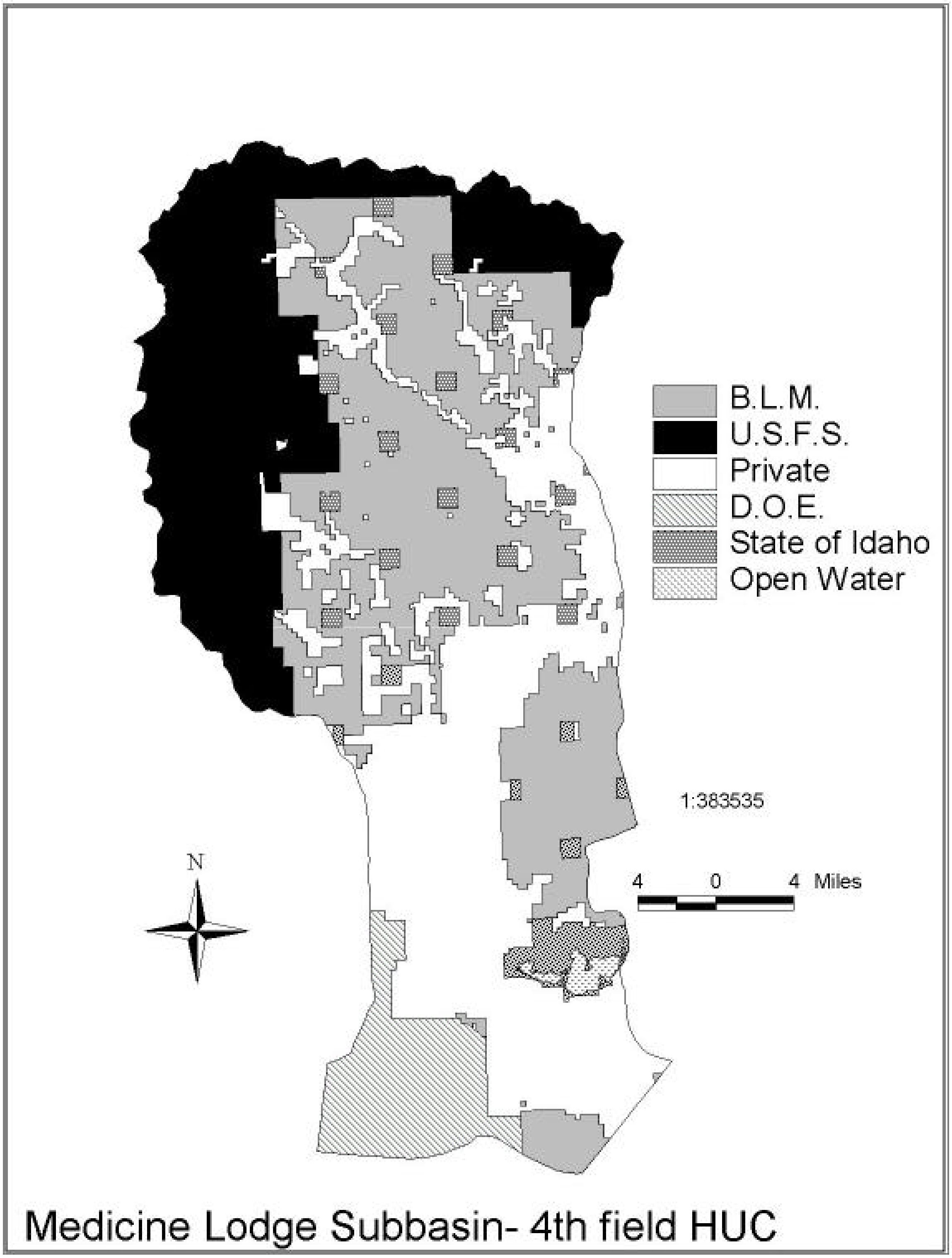


Figure 15. Land Ownership in the Medicine Lodge Subbasin